UTILITY PATENT APPLICATION TRANSMITTAL

☐ DUPLICATE

Address to:		
Assistant Commissioner for Patents Box PATENT APPLICATION Washington, DC 20231	Attorney Docket No.	EM/CHEN/5997
	First Named Inventor (or identifier)	Wen-Kuan CHEN
	Total Pages	25

Transmitted herewith is a patent application under 37 CFR 1.53(b).

Entitled: HIGH-RESOLUTION STILL PICTURE DECODING DEVICE

☒ 1. **Submitted herewith are the following:**

13pages of specification, including claims and Abstract.
7 sheets of FORMAL drawings.
13 claims.
1 Oath/Declaration signed by each inventor.
1 signed Small Business Small Entity Statement.
1 Assignment of the invention, Cover Sheet, and payment of the $40.00 recordal fee.
1 check in the amount of $385.00 including any assignment recordal fee.

☒ 2. **The Commissioner is authorized to credit any overpayment and charge any deficiency in any fees required under 37 CFR 1.16 and/or 1.17, to Deposit Account No. 02-0200.**

☐ 3. Insert before the first sentence of the specification: - - This application claims the benefit of provisional application number _____ filed _____. - -

☐ 4. Insert before the first sentence of the specification: - - This application is a Continuation-in-part of nonprovisional application number _____ filed _____. - -

☐ 5. Other:_____.

THE FILING FEE IS CALCULATED AS FOLLOWS:				Basic Fee:	$690.00
Total Claims:	13	- 20 =	0	X $18 =	0.00
Independent Claims:	1	- 3 =	0	X $78 =	0.00
Correspondence Address: BACON & THOMAS, PLLC 625 Slaters Lane, 4th Floor Alexandria, VA 22314-1176				Multiple Dependent Claim (add $260.00):	0.00
				Subtotal:	690.00
				50% Reduction if Small Entity Status:	345.00
Phone: 703-683-0500 Fax: 703-683-1080				Total:	345.00

Date:	Name:	Signature:	Reg. No.
September 8, 2000	Eugene Mar		25,893

(29Dec1999)

Small Business

VERIFIED STATEMENT (DECLARATION) BY A SMALL BUSINESS CLAIMING SMALL ENTITY STATUS UNDER *37 CFR 1.9(F) AND 1.27(C)*

Applicant or Patentee: **Wen-Kuan Chen**	Docket #:
Serial or Patent Number:	Group Art Unit:
Filed or Issued:	Examiner:
Title: **"High-Resolution Still Picture Decoding Device"**	

I hereby declare that I am

- ☐ the owner of the small business concern identified below:
- ☒ an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern: **SUNPLUS TECHNOLOGY CO. , LTD.**

Address: **19, Innovation Road 1, Science-Based Industrial Park, Hsin-Chu, Taiwan R. O. C.**

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in *13 CFR 121.3-18*, and reproduced in *37 CFR 1.9(d)*, for purposes of paying reduced fees under *section 41(a) and (b) of Title 35, United States Code*, in that the number of employees of the concern, including those of its affiliates, **does not exceed 500 persons**. For purposes of this statement, **(1)** the number of employees is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and **(2)** concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the matter described in:

- ☒ The specification filed herewith, with the title as listed above.
- ☐ The patent application identified above.
- ☐ The PCT international patent application identified above.
- ☐ The patent number identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under *37 CFR 1.9(c)* if that person made the invention, or to any concern who would not qualify as a small business concern under *37 CFR 1.9(d)*, or a nonprofit organization under *37 CFR 1.9(e)*. Each person, concern or organization having any rights in the invention is listed below:

- ☒ no such person, concern or organization.
- ☐ each such person, concern or organization listed below:

Full Name:	☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization
Address:	

Full Name:	☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization
Address:	

☐ See attached sheet for additional person(s) concern(s) or organization(s).

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small
entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate *(37 CFR 1.28(b))*.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine, or imprisonment, or both, under section *1001 of Title 18 of the United States Code*, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which the verified statement is
directed.

Name and Title **Chou-Chye Huang (President)**	*Date* **August 25, 2000**
Address **19, Innovation Road 1, Science-Based Industrial Park, Hsin-Chu, Taiwan R. O. C.**	*Signature* Chou-Chye Huang

HIGH-RESOLUTION STILL PICTURE DECODING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a device for decoding a still picture and, more particularly, to a decoding device capable of displaying high-resolution still picture with limited memory.

2. Description of Related Art

Recently, because the video and multimedia applications have become so popular, the video compress and de-compress techniques, such as MPEG1, MPEG2 and H.263, are in wide spread use. FIG. 8 shows the structure that implements the compress and de-compress process. First, bit-stream data is read from a storage media 88 and then sent to a variable-length decoder (VLD) 81 for decompressing the Huffman data. A run-length decoder (RLD) 82 is provided to pad zeros into the decompressed Huffman data and send it to an inverse quantizer (INVQ) 83 to reconstruct time domain data. Finally, an inverse discrete cosine transformation (IDCT) unit 84 is provided to process the data to complete the decoding process. When the process is applied to a general system, for example, VCD, SVCD, or DVD, there are many high-resolution still picture applications. The high-resolution data is decoded and stored in dynamic random access memory (DRAM) 85 to furnish displaying data on the television device 86. In the VCD application, the data size of a PAL full frame is 704× 576× 1.5 = 608,256 bytes. However, in a typically VCD application, the system usually has 4M bit DRAM, which is equal to 512K byte and is obviously less than 608,256

bytes. Moreover, there may be other demands for memory, such as the memory for processing OSD (On Screen Display) and audio signal. Therefore, it is difficult to achieve the aforementioned functions with limited memory.

To solve the problem, a direct way is to discard part of the picture data for decreasing the required memory. However, this may significantly reduce the output resolution and thus derogate the output image quality. Therefore, there is a need to have a novel design for displaying high-resolution still picture with limited memory.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a high-resolution still picture decoding device, such that the device can decode high-resolution still picture with limited memory while the operating frequency thereof is not increased.

To achieve the object, the high-resolution still picture decoding device of the present invention includes a memory device and a decoding means. The memory device has a bit-stream buffer, a temporary buffer and a frame buffer, wherein the bit-stream buffer is used to store bit-stream data from a storage media. The decoding means is provided for decoding the bit-stream data in the bit-stream buffer and storing decoded frame data in the frame buffer or the temporary buffer, such that, when a still picture is to be displayed, the frame buffer stores part of the frame data corresponding to the still picture and the temporary buffer is provided to store the other frame data which is decoded in real time as the still picture is displayed, and the data in the frame buffer and temporary

buffer is output for displaying a high-resolution still picture.

Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the hardware architecture of a high-resolution still picture decoding device in accordance with a preferred embodiment of the present invention;

FIG. 2A schematically illustrates a luminance macroblock;

FIG. 2B schematically illustrates a chrominance macroblock;

FIG. 3A schematically illustrates the frame data format for luminance component;

FIG. 3B schematically illustrates the frame data format for chrominance component;

FIG. 4A schematically illustrates the luminance macroblock lines stored in a frame buffer in accordance with the present invention;

FIG. 4B schematically illustrates the luminance macroblock lines stored in a temporary buffer in accordance with the present invention;

FIG. 4C schematically illustrates the chrominance macroblock lines stored in the frame buffer in accordance with the present invention;

FIG. 4D schematically illustrates the chrominance macroblock lines stored in the temporary buffer in accordance with the present invention;

FIG. 5 shows a practical timing sequence for displaying high-resolution still picture;

FIG. 6 shows a bit-stream decoding flowchart in accordance with the present invention;

FIG. 7 shows the use of two pointer to point to the bit-stream buffer for setting a picture range to perform read operations in a cyclic and repeated manner; and

FIG. 8 shows a hardware structure of a conventional still picture decoding device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is illustrated a schematic diagram of a high-resolution still picture decoding device in accordance with a preferred embodiment of the present invention, which is composed of a memory device 11, an image decoder 12, a decoding controller 13 and a multiplexer 14. The memory device 11 is programmed to have a bit-stream buffer 111, a temporary buffer 112 (TBUF) and a frame buffer 113 (FBUF). The bit-stream data that represents a video frame is read from a storage media 15 and stored in the bit-stream buffer 111. Under the control of the decoding controller 13, the image decoder 12 decodes the data in the bit-stream buffer 111 and stores the decoded frame data in the memory device 11, so as to display the corresponding picture on a television device 16.

The aforementioned image decoder 12 is provided to decode the bit-stream data for generating the corresponding video frame. Taking the MPEG system as an example, a video frame is composed of multiple macroblocks (MB), each having a luminance component and a chrominance component. With reference to FIG. 2A, the corresponding

macroblock of luminance component (denoted as Y-MB) has 16× 16 pixels, each representing a luminance value. With reference to FIG. 2B, the corresponding macroblock of chrominance component is composed of a blue macroblock (denoted as Cb-MB) and a red macroblock (denoted as Cr-MB). Each of the Cb-MB and Cr-MB has 8× 8 pixels. A pixel in the Cb-MB represents a blue chrominance value and a pixel in the Cr-MB represents a red chrominance value. Therefore, each chrominance macroblock (denoted as CbCr-MB) has 8× 16 pixels.

For saving the memory space, only a part of the frame data in the frame buffer 113 of the memory device 11 is kept, while the rest of the frame data is decoded in real time for being displayed as the still picture. Taking the QSIF format (frame size is 352 pixel× 288 line) of MPEG1 as an example, the FIG. 3A and FIG. 3B show the decoded raw frame data (i.e., without interpolation) of luminance and chrominance component, respectively. The frame data is composed a plurality of macroblock lines (MBLs). The luminance part contains 18 macroblock lines (numbered from 0 to 17), and each macroblock line has 352× 16 pixels (i.e. 22 Y-MB), and the chrominance part also has 18 macroblock lines (numbered from 0 to 17), and each macroblock line has 352× 8 CbCr pixels interleavingly arranged (i.e., 22 CbCr-MB).

In this preferred embodiment, only half of the frame data is stored in the frame buffer 113 of the memory device 11. Referencing to FIG. 4A and FIG. 4C, FIG. 4A shows that the even numbered luminance macroblock lines, as shown in FIG. 3A, are kept in the frame buffer 113, and FIG. 4C shows that the even numbered chrominance macroblock

lines, as shown in FIG. 3B, are kept in the frame buffer 113. The temporary buffer 112 with a small amount of memory is provided to dynamically store the macroblock lines that are not kept in memory, and the dynamically stored macroblock lines are decoded in real-time for being displayed as the still picture picture. As the still picture is displayed in an interlace manner, the height of the macroblock lines in the temporary buffer 112 is only half of that of the macroblock lines in the frame buffer 113. FIG. 4B and FIG. 4D respectively illustrate the macroblock lines of the luminance and chrominance in the temporary buffer 112. The temporary buffer 112 should have a memory space for containing at least one luminance macroblock line and at least one chrominance macroblock line. In this preferred embodiment, the memory space of the temporary buffer 112 can contain 4 luminance macroblock lines and 4 chrominance macroblock lines.

FIG. 5 shows a practical timing sequence as displaying a high-resolution still picture, wherein, each block represents a frame field. Tn represents the displaying time for the top field of the n-th frame, and Bn represents the displaying time for the bottom field of the n-th frame. If system is switched to display a still picture in the areas of the fields 51, 52 and 53, the bit-stream of a frame from the bit-stream buffer 111 is decoded, in the time points of the fields 51, 52 and 53, by the bit-stream decoding flow as shown in FIG. 6. In one field display time of the top filed, a first decoding process, as denoted by dash line, is carried out to decode the even numbered macroblock lines by using the image decoding device12, and the decoded frame data is stored in the frame

buffer 113. In one field display time of the other fields shown in FIG. 5, the bit-stream of a frame from the bit-stream buffer 111 is decoded by a second decoding process, as denoted by solid line, shown in FIG. 6 for decoding the odd numbered macroblock lines by using the image decoding device12, and the decoded frame data is stored in temporary buffer 112. Therefore, if the frame data corresponding to the field required to be stored in the memory device 11 is decoded, in a time duration for displaying the data of a macroblock line, based on the second decoding process and stored in the temporary buffer 112, the display of still pictures can be fulfilled. That is, under the control of the decoding controller 13, the decoded data stored in the frame buffer 113 and temporary buffer 112 is applied to the multiplexer 14 for selecting one to output to the TV device 16 for display.

The aforementioned macroblock lines, which are kept in the frame buffer 113, are stored in a manner of skipping one macroblock line. However, the macroblock lines can be stored in a manner of skipping more than one macroblock lines or skipping irregular numbers of macroblock lines. The operations thereof are analogous to the aforementioned embodiment.

Also with reference to FIG. 5, the second decoding process is undertaken repeatedly in the field display time that is not for displaying still picture. Therefore, as shown in FIG. 7, it is preferred to have a pointer P_n for pointing to the head of the n-th picture and a pointer P_{n+1} for pointing to the head of the (n+1)-th picture in the bit-stream data when reading bit-stream data from the bit-stream buffer 111. As such, the

read of bit-stream data can be cyclically repeated in the picture range addressed by the two pointers.

With reference to FIG. 1 again, the image decoding device 12 includes a variable-length decoder 121, a run-length decoder 122, an inverse quantizer 123, an inverse discrete cosine transform (IDCT) unit 124 and a DC predictor 125. From the above description, it is known that bit-stream data is read out from the storage media 15 and stored in bit-stream data buffer 111. The decoding controller 13 transfers the data, as shown in FIG. 7, to the variable-length decoder 121. The data is processed by the run-length decoder 122, inverse quantizer 123 and inverse discrete cosine transform unit 124 sequentially. Because the decoding process shown in FIG. 6 is carried out by skipping one or more macroblock lines, the variable-length decoder 121 must be able to discard the unnecessary macroblock lines. However, in the MPEG 1 specification, a slice may be across over several macroblock lines. Therefore, the bit-stream data processed by the variable-length decoder 112 is forwarded to the DC predictor 125 to preserve its DC component. If the bit-stream data is of the MPEG 2 format, the DC predictor 125 can be turned off, and the data to be process is of the format having one macroblock skipped.

The data which is decoded by and output from the inverse discrete cosine transform unit 124 is stored in frame buffer 113 or temporary buffer 112 of the memory device 11, under the control of the decoding controller 13. When the data is to be stored in the frame buffer 113, a whole macroblock must be stored, and thus, the inverse discrete

cosine transform unit 124 processes the data from the inverse quantizer 123 and stores the data in frame buffer 113 completely. As for the data to be stored in the temporary buffer 112, only the data required for a field is determined.

In view of the foregoing, it is appreciated that the present invention only needs to store half of the frame data by the particular management of frame data. Further with the help of proper management of bit-stream buffer and the skipping macroblock process of the variable-length decoder, it can effectively display a still picture with a limited memory. The resolution and quality of the decoded still picture are satisfactory. In addition, the operating frequency of the decoding structure is not increased.

Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

WHAT IS CLAIMED IS:

1. A high-resolution still picture decoding device, comprising:

a memory device having a bit-stream buffer, a temporary buffer and a frame buffer, the bit-stream buffer being adapted to store bit-stream data from a storage media; and

a decoding means for decoding the bit-stream data in the bit-stream buffer and storing decoded frame data in the frame buffer or the temporary buffer, such that, when a still picture is to be displayed, the frame buffer stores part of the frame data corresponding to the still picture and the temporary buffer is provided to store the other frame data which is decoded in real time as the still picture is displayed, and the data in the frame buffer and temporary buffer is output for displaying a high-resolution still picture.

2. The high-resolution still picture decoding device as claimed in claim 1, wherein the frame buffer stores only a half of the frame data corresponding to the picture, and the temporary buffer has a memory space less than that of the frame buffer.

3. The high-resolution still picture decoding device as claimed in claim 1, wherein the frame data in the bit-stream buffer is represented by multiple macroblock lines after being decoded by the decoding means.

4. The high-resolution still picture decoding device as claimed in claim 3, wherein the frame buffer only stores part of the macroblock line corresponding to the frame data of the still picture, and the temporary buffer has a memory space for storing at least one macroblock line.

5. The high-resolution still picture decoding device as claimed in claim 4, wherein the frame buffer stores even numbered macroblock lines corresponding to the frame data of the picture.

6. The high-resolution still picture decoding device as claimed in claim 5, wherein the macroblock lines in the temporary buffer has a height half of the height of the macroblock lines in the frame buffer.

7. The high-resolution still picture decoding device as claimed in claim 5, wherein, for a field of a displaying still picture and in a time point of switching to display the still picture, the bit-stream of a frame from the bit-stream buffer is processed by a first decoding process in one field display time of a top filed to decode the even numbered macroblock lines, and the decoded frame data is stored in the frame buffer, while in one field display time of the other fields, the bit-stream of a frame from the bit-stream buffer is processed by a second decoding process to decode the odd numbered macroblock lines.

8. The high-resolution still picture decoding device as claimed in claim 1, wherein the second decoding process is repeatedly executed and there are two pointers for setting a picture range in which read operations of bit-stream data can be cyclically repeated.

9. The high-resolution still picture decoding device as claimed in claim 8, wherein the decoding means has an image decoder which comprises a variable-length decoder, a run-length decoder, an inverse quantizer and an inverse discrete cosine transform unit, and data read out from bit-stream buffer is processed by the variable-length decoder, run-length decoder, inverse quantizer, and inverse discrete cosine transform

unit sequentially for being stored in frame buffer or temporary buffer.

10. The high-resolution still picture decoding device as claimed in claim 9, wherein the variable-length decoder can discard unnecessary macroblock lines for decoding.

11. The high-resolution still picture decoding device as claimed in claim 9, wherein the image decoder further comprises a DC predictor for preserving DC component of the bit-stream data processed by the variable-length decoder.

12. The high-resolution still picture decoding device as claimed in claim 9, wherein, only data of one field is determined by the inverse discrete cosine transform for being stored into the temporary buffer.

13. The high-resolution still picture decoding device as claimed in claim 1, further comprising a multiplexer which select data in the frame buffer or the temporary buffer to output.

ABSTRACT OF THE DISCLOSURE

A high-resolution still picture decoding device is disclosed, which has a memory device, an image decoder, and a decoding controller. The memory device has a bit-stream buffer, a frame buffer and a temporary buffer. The image decoder and decoding controller decode the bit-stream data in the bit-stream buffer and store the decoded data in the frame buffer or temporary buffer. When a still picture is to be displayed, the frame buffer stores part of the frame data corresponding to the still picture and the temporary buffer is provided to store the other frame data which is decoded in real time as the still picture is displayed. The data in the frame buffer and temporary buffer is output for displaying a high-resolution still picture.

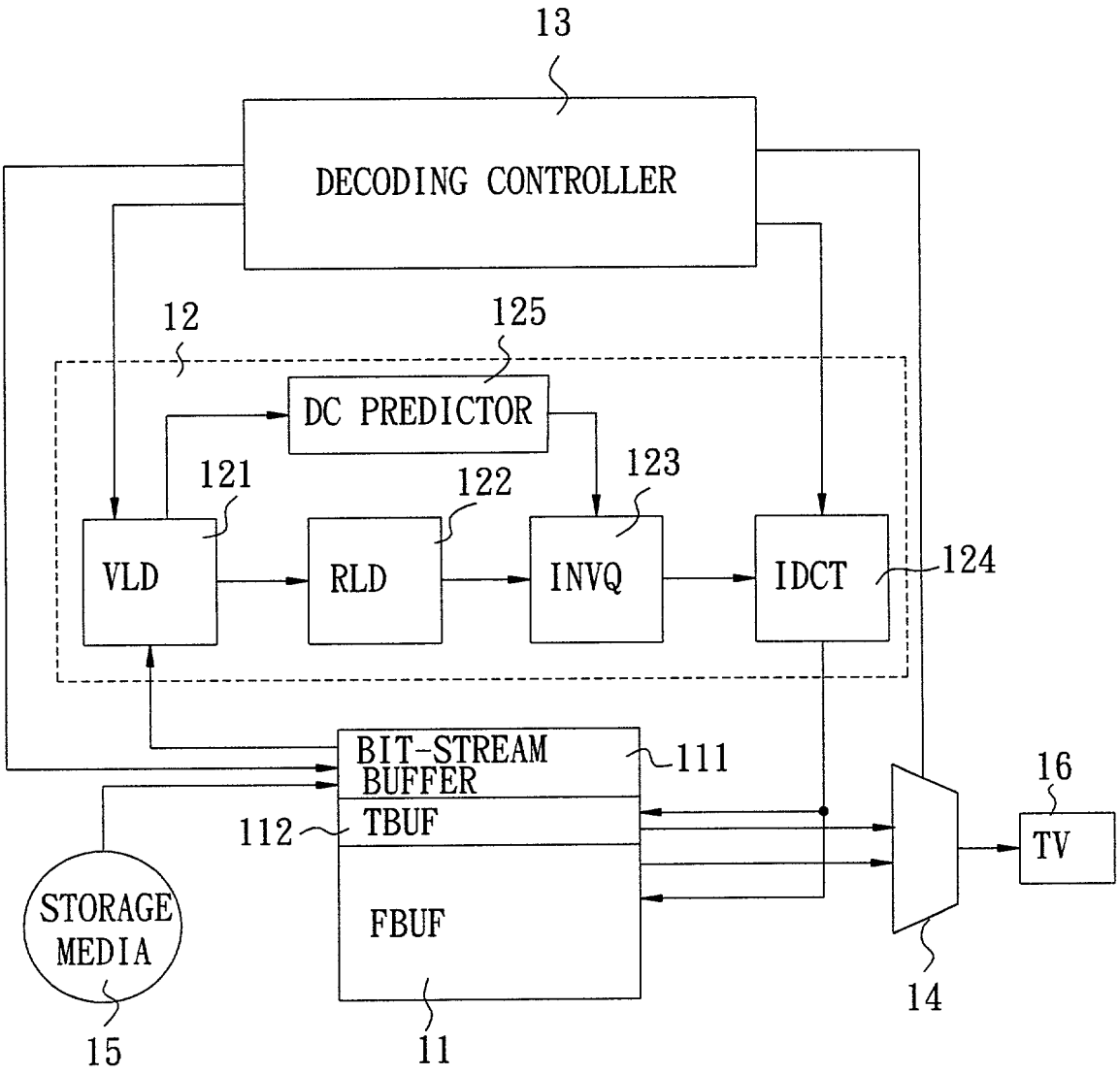
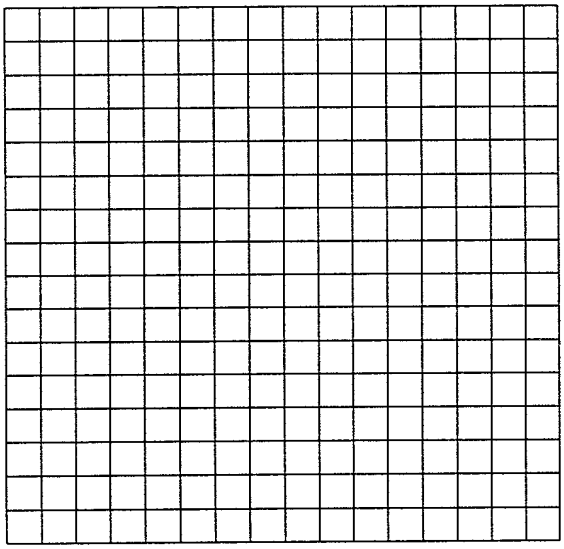
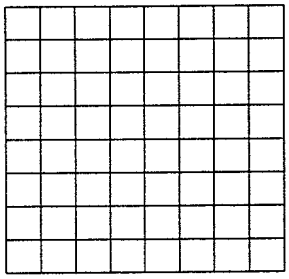

13
DECODING CONTROLLER
12
125
DC PREDICTOR
121
122
123
VLD
RLD
INVQ
IDCT
124
BIT-STREAM BUFFER
111
112
TBUF
FBUF
STORAGE MEDIA
15
11
14
16
TV

FIG. 1

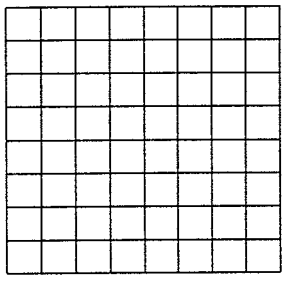


MB PIXELS OF Y COMPONENT

FIG. 2A



MB PIXELS OF Cb COMPONENT



MB PIXELS OF Cr COMPONENT

FIG. 2B

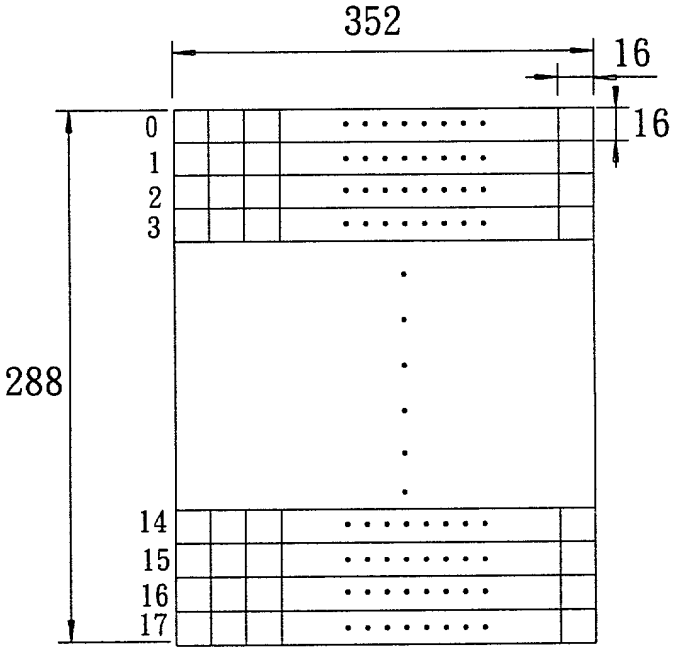


FIG. 3A

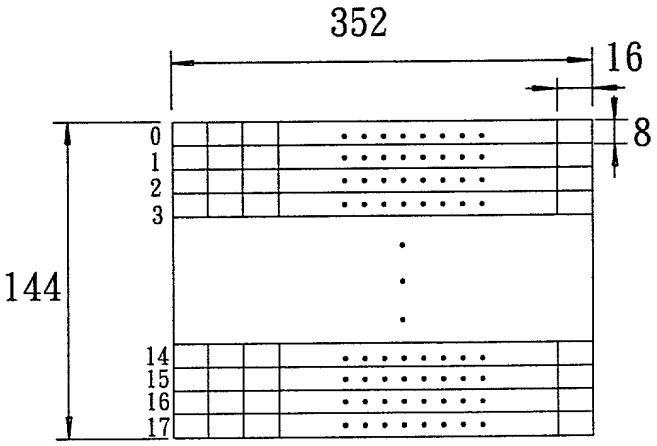


FIG. 3B

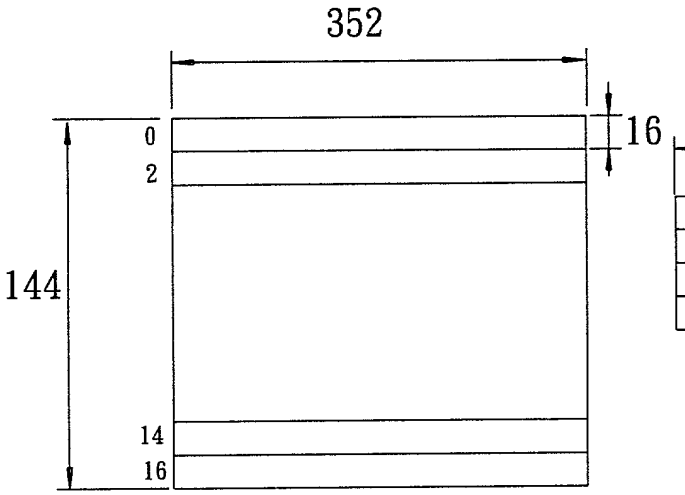


FIG. 4A

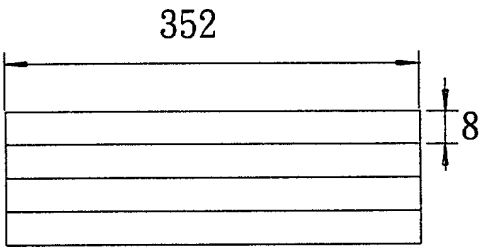


FIG. 4B

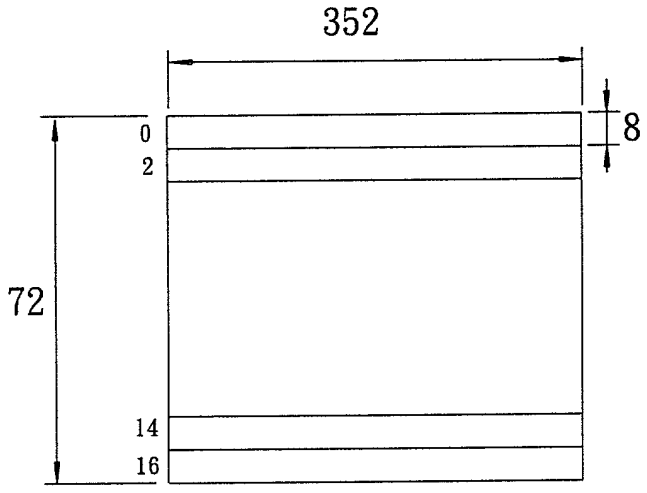


FIG. 4C

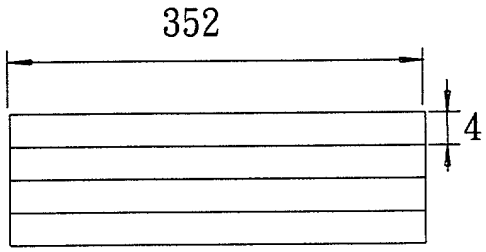


FIG. 4D

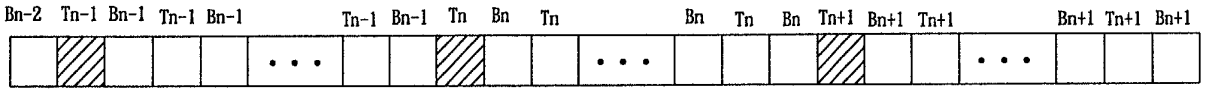
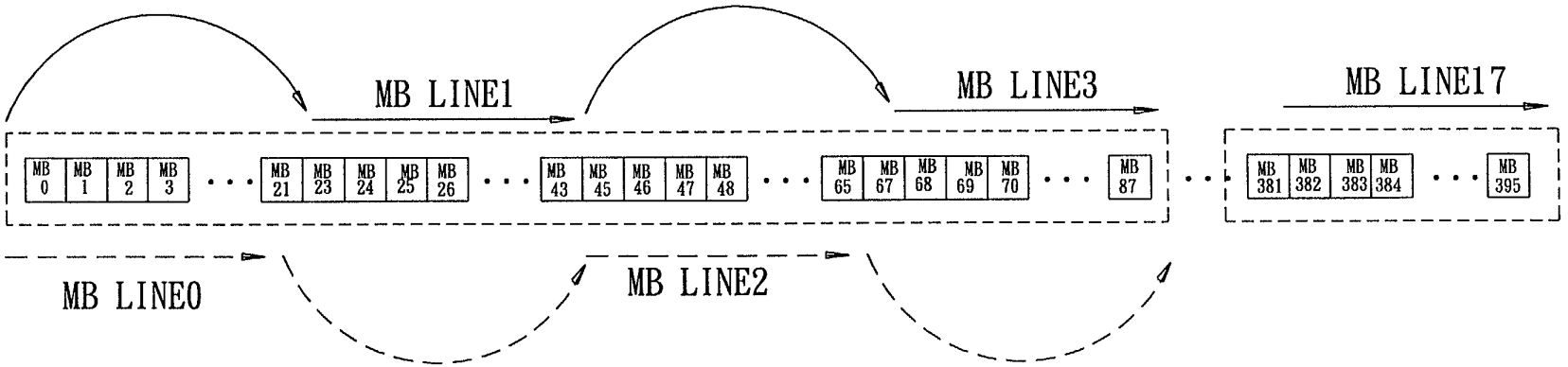

Bn-2 Tn-1 Bn-1 Tn-1 Bn-1 Tn-1 Bn-1 Tn Bn Tn Bn Tn Bn Tn+1 Bn+1 Tn+1 Bn+1 Tn+1 Bn+1

FIG. 5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MB LINE3
MB LINE17
MB 0 MB 1 MB 2 MB 3
MB 21 MB 23 MB 24 MB 25 MB 26
MB 43 MB 45 MB 46 MB 47 MB 48
MB 65 MB 67 MB 68 MB 69 MB 70
MB 87
MB 381 MB 382 MB 383 MB 384
MB 395
MB LINE0
MB LINE2

FIG. 6

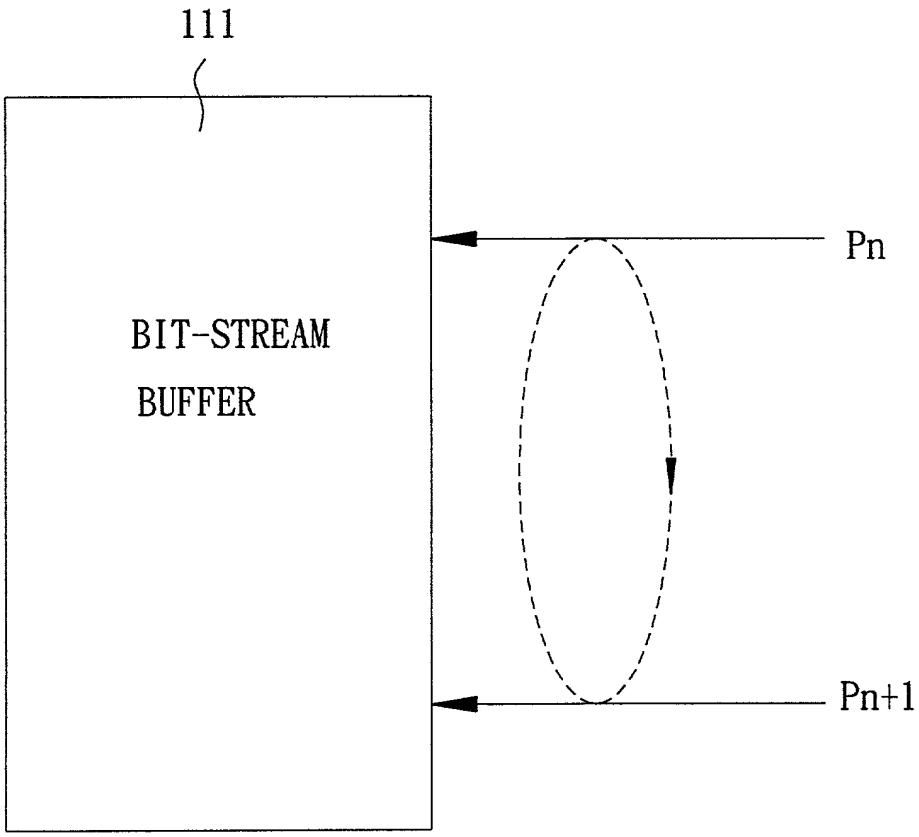

FIG. 7

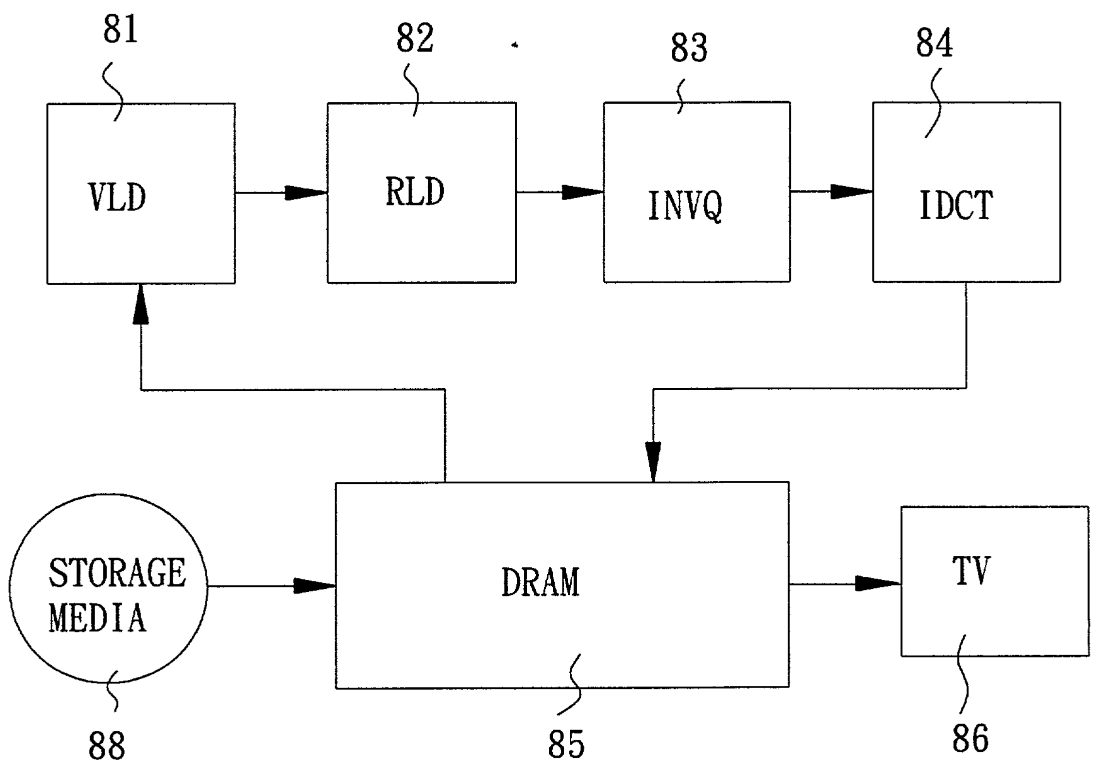

FIG. 8
PRIOR ART

ATTORNEY/DOCKET NO:

DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled:
"High-Resolution Still Picture Decoding Device"

the specification of which: (check one)

☒ is attached hereto

☐ was filed on: as Application Serial No.:
and (if applicable) was amended on:

☐ was filed on: as International Application (PCT) No.:
and (if applicable) was amended on:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, 1.56.* I hereby claim foreign priority benefits under *Title 35, United States Code 119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			*PRIORITY CLAIMED*	
Number	*Country*	*Day/Month/Year Filed*	*Yes*	*No*
89113059	**Taiwan R. O. C.**	**30/6/2000**		**X**

I hereby claim the benefit under *Title 35, United States Code, § 120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, § 112,* I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, § 1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application No.	*Filing Date*	*Status – Patented, Pending or Abandoned*

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF Attorney: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No 26,382; Charles R. Wolfe, Jr., Reg. No. 28,680; Thomas J. Moore, Reg. No. 28,974; Joseph DeBenedictis, Reg. No. 28,502; Benjamin E. Urcia, Reg. No. 33,805; Chung C. Chen, Reg. No. 31,725; and I(we) authorize my(our) attorneys to accept and follow instructions from **WOOD & WU** regarding any matter related to the preparation, examination, grant and maintenance of this application, any continuation, continuation-in-part or divisional based thereon, and any patent resulting therefrom, until I(we) or my(our) assigns withdraw this authorization in writing.

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